

**Ministry of Defence  
Defence Procurement Agency, ADRP2  
Abbey Wood  
Bristol  
BS34 8JH**

## **OBSOLESCENCE NOTICE**

All DTD specifications were declared obsolescent from 1<sup>st</sup> April 1999. All DTD 900 series approvals also lapsed at that time. The standards will no longer be updated but will be retained as obsolescent documents to provide for the servicing of existing equipment.

### **Further Guidance**

The aim in declaring the specifications obsolescent is to recognise that the documents are not being updated and thus should be used with care by both purchaser and supplier. For example, a specification could contain valid technical information but may also contain type approval clauses that contradict procurement policy and/or use materials that do not comply with environmental legislation. The obsolescent specification can still be used as a basis for a purchase provided that the supplier and purchaser agree suitable changes to the specification within the purchase order/contract.

For the DTD 900 system, each specification has provided an MoD approved material and process. For these items, the declaration of obsolescence will constitute the termination of both the extant MoD approval and the continuing MoD assessment that had underpinned those approvals. Again, the technical content of the document remains valid and can be used by both purchaser and supplier as a basis for a contract but an acceptable (to the parties) approval/assessment procedure would be required.

**Aerospace Material Specification  
FLUOROCARBON RUBBER  
(LOW COMPRESSION SET)**

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**Page 4 TABLE**

- (e) Tear strength  
The test method is BS 903 Part A3 (1972 edition)
  
- (j) Resistance to low temperatures  
For all grades of material and both methods of test,  
*delete* - 15°C, and *insert* - 12°C

**Aerospace Material Specification**  
**FLUORO-CARBON RUBBER (LOW COMPRESSION SET)**

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*NOTE 1. This specification is one of a series issued by the Procurement Executive, Ministry of Defence, either to meet a limited requirement not covered by an existing British Standard for aerospace material, or to serve as a basis for inspection of material, the properties and uses of which are not sufficiently developed to warrant submission to the British Standards Institution for standardization.*

*NOTE 2. It is one of a series of rubber specifications in which the material is classified by the base polymer employed.*

*NOTE 3. The tests employed in this specification are chosen for their reproducibility and ability to control the properties of the material. They are not intended to be simulated service tests, which, because of variability of test conditions, may be unsatisfactory for control purposes.*

*NOTE 4. The intended applications and the limitations of materials to this specification are given in Section 1 of the specification and are for guidance only. In case of doubt users are advised to confirm the suitability of the material for any given application.*

*NOTE 5. Further guidance on the choice of rubber for any particular purposes may be obtained from Appendix 1 of DR Mat Tech Memo No 7 "Rubber in Engineering Design", and SBAC TS No 97 "Recommended Design Guide for Rubber Materials for Aerospace Applications".*

*NOTE 6. This specification calls for the use of substances and/or test procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and in no way absolves either the supplier or the user from statutory obligations related to health and safety at any stage of manufacture or use.*

*This specification has been devised for the use of the Ministry of Defence and its contractors in the execution of contracts for the Ministry and, subject to the Unfair Contract Terms Act 1977, the Ministry will not be liable in any way whatever (including but without limitation negligence on the part of the Ministry, its servants or agents) where the specification is used for other purposes.*

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## SECTION 1

### Scope

#### 1.1 Scope

The materials covered by this specification are intended mainly for the manufacture of seals which are normally required to operate at temperatures up to +225°C in contact with air, petroleum-based and diester-based fluids where low compression set is of primary importance. For static applications, the materials may be suitable for use at temperatures down to -50°C, but with increasing frequency/amplitude the low temperature behaviour will deteriorate and they may not be suitable below -20°C.

In certain applications, the materials may be suitable in contact with silicone and silicate ester fluids, but where such use is contemplated the designer should satisfy himself of the suitability of the material for the particular application.

The materials are not suitable for use with certain phosphate ester-based fluids.

*NOTE. At ordinary temperatures and in the absence of hostile environments, eg when properly stored, these rubbers deteriorate only very slowly. For most practical purposes the effect is insignificant and the storage life of fluoro-carbon rubbers may be considered indefinite. However, the rate of deterioration increases markedly with increased temperature and the service life of the rubber therefore depends upon the operational temperature. Conversely, the maximum temperature at which the rubber may be used depends upon the useful life required.*

#### 1.2 Classification

Five different hardness values are covered (Grades 50, 60, 70, 80 and 90, Grade 50 being the softest) and the grade required must therefore be stated on all drawings and contracts. Where a nominal hardness other than those quoted is necessary, this can be specified and the basic requirements other than hardness shall be those specified for the grade embracing the proposed nominal hardness. If a tolerance is required which is tighter than those quoted (+5, -4) this should be specified but should not be less than  $\pm 3$ .

## SECTION 2

### Related Documents

- 2 Reference is made in this document to the following:
- BS 903 - Methods of testing vulcanized rubber.
  - BS 1134 - Centre line average height. Method for the assessment of surface texture.
  - BS 3734 - Schedule of tolerances for rubber products in solid rubber and ebonite.
  - BS F69 - Packaging and identification of vulcanized rubber items.

The related documents listed are those applicable at the date of publication of this specification. Their current applicability must be confirmed by all users of the specification. The Quality Assurance Authority will supply, on request, information concerning any changes that may be necessary due to cancellation, replacement, supersession or amendment of any related document.

## SECTION 3

### General Requirements

#### 3.1 Composition

The materials covered by this specification shall consist of a fluorocarbon polymer suitably compounded and cured to meet the requirements of Sections 4 and 5 of this specification. No reclaim or ground vulcanized waste shall be used. All ingredients of the mix shall be of recognised rubber quality and shall be free from foreign matter.

#### 3.2 Freedom from Defects

The selection and processing of the ingredients shall be such that the mix is homogeneous and that the parts made from it shall be free from surface imperfections, blisters, porosity, inclusions and undispersed ingredients and other defects which would impair satisfactory performance.

## SECTION 4

### Type Approval of Rubber Compounds

#### 4 Type Approval

- 4.1 Before any particular rubber compound can be accepted as complying with the requirements of this specification, it shall have received type approval. To obtain such approval, the manufacturer (of the fully compounded stock) shall satisfy the type approving authority that the compound will meet all the requirements of this specification.
- 4.2 The type approving authority for material to this specification is:  
 Director, Materials Quality Assurance (DMQA)  
 Headquarters Building, Royal Arsenal East  
 Woolwich, London SE18 6TD
- 4.3 When applying for type approval the manufacturer shall submit the following:
- 4.3.1 Full details of the composition together with details of the standard vulcanizing condition applicable to the test sheet. This information will be treated as confidential.
  - 4.3.2 A sample of the vulcanized material consisting of two sheets, each in the form of a two-thickness test sheet, vulcanized at a temperature appropriate to the mix for a time appropriate to the thickness of the test sheet. No additional vulcanizing shall be given to the thicker portion of the test sheet. Each sheet shall be approximately 250mm square,  $2.00 \pm 0.15$ mm thick, with a section along one side 35-50mm wide and  $6.30 \pm 0.15$ mm thick. If desired for the purpose of compression set tests, part of the 6.30mm thick section may be moulded in the form of cylindrical buttons conforming to the requirements of a Type 1 test piece as defined in BS 903: Part A6. When such buttons are moulded, the cavities shall be individually charged with pellets and not by the flow of excess mix from the remainder of the mould. No additional vulcanizing shall be given to the buttons. The minimum number of buttons moulded shall be nine and they shall be in a group at one end of the thick section.
  - 4.3.3 Test results on a sample identical to the one submitted and prepared from the same batch of material.
  - 4.3.4 The proposed value for nominal density and, if required, nominal hardness (see Clause 1.2).

#### 4.4 Tests

The tests listed in the Table shall be carried out on test pieces cut from the sample sheet specified in Clause 4.3.2. Each property of the material, when determined by the method given in the Table, shall comply with the requirement also listed in the Table.

No absolute limits are set for density but this shall be determined and a nominal value agreed between the manufacturer and the type approving authority.

**4.5** After formal type approval has been given, no change in composition or test sheet vulcanizing conditions shall be made without the consent of the type approving authority.

**4.6 Duration of Approval**

Type approval shall last for a period of five years.

A manufacturer may then apply for re-approval with a submission following the requirements of the specification current at the time of re-submission.

Re-approval shall also last for five years.

There is no limit to the number of re-approvals possible, provided that the material complies with all the requirements of the specification current at each re-submission.

**SECTION 5**

**Routine Quality Control**

**5 Frequency of Testing**

**5.1** The first production batch and subsequently at least every tenth batch of mix shall be tested for compliance with the requirements of tests (a) to (j) inclusive of the Table on a sample sheet as described in 4.3.2.

**5.2** All other batches shall be similarly tested for compliance with the requirements of tests (a), (b), (f)(i), (h)(i) and (h)(iii) of the Table.

**5.3** The Quality Assurance Authority may, at any time, require any batch to be checked for compliance with any requirement in the Table.

**SECTION 6**

**Rubber Items (Parts or Components)**

**6 Manufacture and Inspection**

**6.1 Manufacture**

Rubber items shall be manufactured from material which complies with all the requirements of Sections 3,4 and 5 of this specification.

**6.2 Inspection**

If the finished items are required to comply with a specification relevant to that item, they shall be inspected and tested for compliance with the requirements of that specification.

In the absence of such a specification, the following shall apply:

**6.2.1 Sampling**

Unless otherwise agreed with the customer or Quality Assurance Authority concerned, sample items shall be taken from each lot produced from each batch of mix.

**6.2.2 Freedom from defects**

Finished rubber items shall be free from surface imperfections, porosity, voids, inclusions, flow marks or inadequate joint of moulding blank and of other defects which would impair satisfactory performance, eg excessive grain in calendered sheet or extrusions.

Surface finish shall be smooth, unless otherwise stated in the relevant drawing, contract or order, eg items may be specified with shallow cloth marking on one or more surfaces.

**6.2.3 Dimensions**

The dimensions and tolerances of finished rubber items shall be as stated on the relevant drawing, contract or order. Methods of measurement of dimensions shall be in accordance with BS 3734 unless otherwise stated.

**6.2.4 Physical tests**

Sample items shall be tested as agreed with the customer or Quality Assurance Authority concerned, due regard being paid to whether standard test pieces can be obtained from them. The requirements for the results of such tests, if not complying with the requirements of the Table (eg where results are reported as apparent hardness or are obtained on test pieces which have been buffed during preparation), shall be agreed with the customer or Quality Assurance Authority concerned.

**6.2.5 Chemical tests**

Chemical analysis may be carried out on sample items, as practicable, to verify that the composition is essentially in accordance with Section 3.

**6.3 Quality assurance documents**

The manufacturer shall state on each quality assurance document (eg certificate of conformity) the part number, the specification number and grade, date of vulcanization (quarter and year), the item lot number, and compound reference (manufacturer's designation) of the rubber material used.

#### 6.4 Packaging and identification

Unless otherwise stated on the drawing or in the contract or order, components shall be packaged and the package identified in accordance with the requirements of BS F69.

TABLE

Test	Test requirements					Test method
	Grade 50	Grade 60	Grade 70	Grade 80	Grade 90	
(a) Hardness, IRHD	50 + 5 -4	60 + 5 -4	70 + 5 -4	80 + 5 -4	90 + 3 -4	Appendix I
(b) Density	Within $\pm 0.02$ Mg/m <sup>3</sup> of the agreed value					BS 903 Part A1 Method A
(c) Tensile strength, MPa min	9.0	11.0	11.0	11.0	11.0	BS 903 Part A2 Dumb-bell test piece
(d) Elongation at break, % min	180	180	150	120	100	BS 903 Part A2 Dumb-bell test piece
(e) Tear strength, N min	25	40	40	35	35	BS 903 Part A3
(f) Compression set, % max						Appendix II
(i) After 24 hr compression	15	15	15	15	20	
(ii) After 336 hr compression	55	50	50	50	55	
(g) Resistance to liquids						Appendix III
(i) Volume change after immersion in test fluid, % max						
(a) liquid B	-0 + 10	-0 + 9	-0 + 8	-0 + 7	-0 + 7	
(b) liquid 101	-0 + 12	-0 + 12	-0 + 12	-0 + 10	-0 + 10	
(ii) Change in hardness, IRHD max after immersion in liquid 101	-15	-15	-12	-10	-10	
(h) Resistance to heat ageing						BS 903 Part A19 Method A or B 70 hours at 70 hours at 250° $\pm$ 3°C
(i) Change in hardness, IRHD max	+ 7 -18	$\pm$ 7	$\pm$ 6	$\pm$ 6	$\pm$ 6	
(ii) Change in elongation at break % of original value, max.	-20	-20	-20	-20	-20	
(iii) Loss in weight, % max	7	7	6	6	6	
(j) Resistance to low temperatures*						BS 903 Part A29 BS 903 Part A13 2.0 mm test piece
(i) TR 10 temperature, °C, max	-15	-15	-15	-15	-15	
or (ii) Temperature °C at which rigidity modulus shall not exceed 70 MPa	-15	-15	-15	-15	-15	
(k) Freedom from adhesion to and corrosion of metals	No adhesion to the metal surface, nor corrosion or pitting of the metal. Discoloration will not be considered a reason for failure.					Appendix IV

\* For test (j), (i), and (ii) are alternative methods, but (j)(i) the TR10 method is preferred and shall be the procedure used in all cases of dispute

**APPENDIX I****Method for the Determination of Hardness**

- (i) Hardness measurements required for Test (a) of the Table shall be made by Method N described in BS 903, Part A26, using one specimen of the thicker part of the test sheet specified in Clause 4.3.2 superimposed upon the thinner part of the same test sheet.
- (ii) For the determination of change in hardness required for Tests (g)(ii) and (h)(i), the measurements shall be carried out, before and after ageing, by Method N described in BS 903, Part A26, using two specimens plied together, of the thinner part of the test sheet specified in Clause 4.3.2.

**APPENDIX II****Method for the Determination of Compression Set**

Compression set measurements shall be made by Method A of BS 903, Part A6, using Type I test pieces from the thicker section of the test sheet specified in Clause 4.3.2. The test pieces shall not be lubricated.

The time of test shall be 24 hours for test (f)(i) and for test (f)(ii) 336 hours and the temperature during the compression shall be  $200^{\circ} \pm 3^{\circ}\text{C}$ .

**Appendix III****Method for the Determination of Resistance to Fluids**

Measurement of volume change, tests (g)(i)(a) and (g)(i)(b) and hardness change, test (g)(ii) shall be made after immersion in:

- (a) test fuel complying with the requirements of Liquid B of BS 903, Part A 16. The temperature of test shall be  $40^{\circ} \pm 1^{\circ}\text{C}$  and the period of immersion 70 (+2, -0) hours.
- (b) test fluid complying with the requirements of Service Liquid 101 of BS 903, Part A 16. The temperature of test shall be  $150^{\circ} \pm 2^{\circ}\text{C}$  and the period of immersion 70 (+2, -0) hours.
- (i) Volume change measurements shall be made by the volumetric method of BS 903, Part A16.
- (ii) Hardness change measurements shall be made as described in Appendix I.

**APPENDIX IV****Method of Test for Freedom from Adhesion to and Corrosion of Metals**

The test shall be made by Method A of BS 903, Part A37, "Assessment of Adhesion to and Corrosion of Metals", with the following exception.

The surface of the metal test pieces shall be finished to a surface texture of 0.4 CLA (as defined in BS 1134) or better before polishing with pumice powder which passes through a  $53 \mu\text{m}$  sieve.

The test shall be carried out for 168 hours at  $200^{\circ} \pm 3^{\circ}\text{C}$  using aluminium and carbon steel test pieces.

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Approved for issue,

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 Farnborough.

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